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BUDGETING UNDER CRITICAL MASS FOR THE NAVY:
AN APPROACH TO PLANNING FOR A STEADY
STATE DEFENSE BUDGET

by

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# Budgeting Under Critical Mass for the Navy: An Approach to Planning for a Steady State Defense Budget

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# ABSTRACT

In a time when defense spending is under close scrutiny, each command faces a potential shortage of funding. There is, in theory, a level of resources, called the critical mass of core resources, below which a command cannot continue to fulfill stated mission objectives. This thesis develops a critical mass/core resource model for use in Navy budgeting and applies the model to the Naval Auxiliary Landing Field, Crows Landing, CA. The model may be more useful than the current incremental approaches in the formulation, negotiation, and execution phases of budgeting. The model provides a framework that may strengthen and protect the command from priorities imposed by outside forces, or, more likely, will permit commands to identify mission opportunity costs or losses resulting from budget cuts. The critical mass model may be superior to current budget formats in the execution phase because resources are formally allocated based on mission priority.

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# I. INTRODUCTION

## A. BACKGROUND

The Department of Defense budget has been flat or in decline in real dollar terms for four fiscal years. William Kaufmann of the Brookings Institution compares incremental budget cutting by political negotiation to the attack of termites.

> It's very rare that they cancel a program or really slash it way back; they are masters of taking a couple of million here and a couple of million there. If they keep doing it that way, and this is the great danger, you end up with a hollow defense. The structure looks like it's there, but if you stomp too hard on it, it will cave in. (Morrison, 1987, p. 34)

His analogy underscores a basic truth brought out in the literature surrounding budgeting in time of financial crisis: Department of Defense planners and budgeters became quickly accustomed to increasing budgets in the 1980's. However, since the 1970's, they have had little experience with cutback management. (Jones, 1984, p. 49) The Reagan golden years of defense spending are drawing to a close. From 1980 to 1985, the average annual rate of real growth in defense spending was 8%. The growth rate dropped 4.2% in 1986 and 2.5% in 1987. (Morrison, 1987, p. 34) The President's budget authority level for 1989 requests only 2.8% increase over the $283 billion in 1988 budget authority or slightly less than projected inflation. (OSD, 1988, p.

91) Using the Congressional Budget Office's assumptions, however, the outlook is bleaker. Before passage of FY89 appropriations, these economic assumptions forecast a 2% decrease in real terms in 1989 budget authority and only a 1% annual increase through 1993. (CBO, 1988, p. 35) During the presidential campaign of 1988, a freeze on the defense budget was discussed. Such a freeze could be applied in real or nominal dollars. Defense budgeting may have to develop alternatives to accommodate reductions. Defense spending over the next years may be, at best, steady state and the unfocused incremental approaches of past decades may not provide the best strategy for budget negotiation or effective execution.

## B. OBJECTIVES

In a time when defense spending is under close scrutiny, each command faces potential shortages of funding. The result is an increased need to justify budget requests more thoroughly. Under this circumstance, formulating models to link dollars to critical mission areas may shift the focus from what can be done with fewer dollars to how much is required to carry out the stated mission. The distribution of dollars among critical mission areas is key to more effective budget formulation and negotiation under circumstances of budget decline, and to more efficient budget execution generally. Budget cutters may find it advantageous and/or necessary to assess the import of mission areas, their costs, interrelationships, and their priorities rather than simply expecting the spenders to accomplish the same mission with fewer resources. In budget execution, a methodology or model approach can be a valuable tool to monitor spending by ensuring that mission priorities are supported by efficient allocation of resources.

There is, in theory, a level of resources below which a command cannot continue to meet all of its mission objectives. This level is the critical mass. A critical mass model (Jones, 1985) may be constructed to delineate the core dollar resources needed to sustain the critical mass. In all three uses, formulation, negotiation, and execution, it would appear to be advantageous to link concrete resource requirements directly to mission objectives.

The impact of budget formats and procedures on decision making is uncertain. Mission decisions are based on budgetary considerations at all levels within the Department of Defense. The critical mass model is a modest departure from the current incremental logic applied to defense budgeting. The model will be applied in this thesis to a Navy command to answer the following questions:

1. Can a suitable model using the concepts of critical mass and core resources be applied at an operational Navy command?

2. If the model can be applied, is it likely to be useful for Navy budget formulation and budget execution? Does it show promise as a valuable decision making tool compared with budgets developed using the current incremental, and non-mission oriented, budgeting practices?

3. If the model appears to be useful as applied to one small Navy installation, can it be applied to more complex activities or at the command level?

4. What impediments are likely to inhibit the development and application of critical mass model at a complex Navy activity/facility?

## C. SCOPE AND LIMITATIONS

In developing a critical mass model, the various missions of an organization must be defined to fit the requirements of the model and their components and interrelationships explored to determine existing dependencies. For this reason, this study will apply the model to a command with only one primary mission. Accordingly, the result will not be a complete test of the critical mass model. However, a core resource distribution across support functions for a single mission area will be accomplished to illustrate how the model is constructed from accounting data.

Naval Auxiliary Landing Field, Crows Landing, CA, is the subject of this study. Crows Landing is administered by Naval Air Station Moffett Field (Moffett) to support the aviation units of Commander Patrol Wings, U.S. Pacific Fleet and NASA Ames Research Laboratory. Specifically, their mission is to "support training facilities for P-3 aircraft touch-and-go operations, Fleet Carrier Landing Practice (FCLP) for fleet aircraft, and to support National Aeronautics and Space Administration (NASA) testing." (COMNAVAIRPACINST 5450.17A) The value of this particular facility as a test is that it has a single, relatively simple primary mission. The core resource distribution will illustrate in concrete terms the minimum level of funding required to support this single mission. The implication for planners and budgeters is that as long as this single mission is essential to all three communities identified in the mission statement, funding cannot be cut below the minimum level derived by application of the model without a commensurate decrease in fleet capability. That is, once the minimum funding has been established, the focus shifts to the impact of this training and testing on fleet readiness and safety. The questions to be answered are no longer in terms of dollars but in terms of ability to locate, identify, track, and, if necessary, destroy the threat.

The relationship between Moffett and Crows Landing directly impacts this study because Moffett assumes responsibility for support of both the facility and the assigned personnel. In other words, numerous functions ranging from administration of military personnel to major overhaul of equipment are excluded when allocating funds assigned specifically to Crows Landing. The implications of this centralized support are significant in answering the research questions.

Since this is a first attempt to apply a critical mass model to a Navy command, some data needed for the study are not readily available in existing accounting systems. Most notably, no mechanism currently exists for distributing indirect costs incurred by an operational command such as Crows Landing among the mission support areas. A proxy distribution based on a one-time estimate provided by the Officer-in-Charge at Crows Landing is used. Unless otherwise noted, fiscal year 1988 (FY88) figures are applied for this analysis.

## D. LITERATURE REVIEW AND METHODOLOGY

This thesis consists of the application of a discrete theoretical model to primary data collected exclusively for this purpose. As such, few secondary sources are used except to introduce the topic. There exists only a single published procedure for application of the critical mass model for budgeting (Jones, 1985). This model is applied in the thesis. Navy mission and cost data are incorporated to develop the model. Data gathering was undertaken at Naval Air Station, Moffett Field and Naval Auxiliary Landing Field, Crows Landing.

## E. COMMAND RELATIONSHIP

In applying critical mass, it is important to delineate exactly what activities are actually missions of that organization. In the Navy, especially, actual missions assigned are often linked to the position in the chain-of-command that an activity occupies. Many responsibilities are informally assumed by tradition, which "tasks" commands with responsibility for areas such as retention of qualified personnel, educational counselling, and other equally nebulous functions. However, chain-of-command and the formal mission, function, and task statement clearly assign these support functions to an appropriate echelon.

At each level of the chain-of-command, there are supporting activities which provide specialized or centralized services not funded by the command. For example, Navy Publications and Printing Service provides printing and duplicating service to Moffett. Pay and personnel administration is centrally controlled for numerous regional activities at the Personal Support Activity, Treasure Island, CA.

In applying the model to Crows Landing, the command relationships are very important since the Commanding Officer of Naval Air Station Moffett Field is explicitly tasked with operating Crows Landing (COMNAVAIRPACINST 5450.17A). This means that centralized support functions, such as medical, motorpool, and maintenance of real property were excluded from the allocation.

Command relationships are defined by COMNAVAIRPACINST 5450.17A as follows:

a. Command

| Echelon | Command |
|---|---|
| 1 | Chief of Naval Operations |
| 2 | Commander in Chief U.S. Pacific Fleet |
| 3 | Commander Naval Air Force, U.S. Pacific Fleet |
| 4 | Commander Light Attack Wing, U.S. Pacific Fleet |
| 5 | Commanding Officer, Naval Air Station Moffett Field... |

Commanding Officer, Naval Air Station Moffett Field is the Immediate Superior in Command (ISIC) of:
(1) Naval Auxiliary Landing Field Crows Landing....

## F. ORGANIZATION

The thesis is presented in five chapters. Chapter I provides general background relating the thesis to current concerns in defense budgeting. Minimum funding level is tied to fleet readiness through the identification of essential missions. This concept of essential missions is contrasted with current incremental budgeting practices which may allow scarce resources to be allocated to non-essential missions. Chapter II presents the critical mass model and assesses its potential utility in Navy budgeting. The chapter examines the need for reevaluating current budgeting practices and suggests reasons that the critical mass model may be germane. This chapter also details the method for applying the critical mass model to a Navy command. Chapter III applies the model to an operational command, Naval Auxiliary Landing Field Crows Landing, CA. Chapter IV summarizes the cost accounting method used in the Crows Landing application. The cost accounting method is not specified in the critical mass model and does not affect its applicability or utility; however, it is included as an example of how core resources may be defined within the critical mass model methodology. Chapter V contains conclusions on the critical mass application at Crows Landing and recommendations for further research. The model as developed may be useful at some levels to improve budget negotiation as well as execution control. Limitations for its use in Navy budget formulation, negotiation, and execution are examined.

# II. THE CASE FOR CRITICAL MASS BUDGETING

## A. PERSPECTIVE

Steady state funding for defense has replaced the increasing defense budget of the period from 1980-1985. For the Navy, RADM Loftus summarized the problem facing budgeters and spenders in the following statement:

> The Navy needs you to continuously work to effectively utilize our resources....You must be constantly vigilant for ways to perform our essential functions more efficiently, including the elimination of unproductive, marginal or unnecessary operations. It's not "bean counting," it's financial management which if done well, can ensure that the Navy has the necessary resources to accomplish its mission. (Loftus, 1988, p. 3)

To respond to this challenge, RADM Loftus suggests that a reorientation of budget strategy may include assessment and evaluation of missions. He also emphasizes execution utility. One model described in academic literature that may meet these requirements is budgeting for critical mass. Although it addresses budget formulation, defense or negotiation, and execution in theoretical terms, there has not yet been a conclusive test of its utility.

Budget justification, whether under conditions of abundance or scarcity, at every stage of the process is the central challenge facing budgeters and comptrollers in the current climate. However, the participants in the budgeting process are not the only critics reassessing traditional budgeting methods and outcomes. Current literature about defense reform also attacks inadequacies in the budgeting process (Epstein, 1987; Kaufmann, 1987; Hendrickson, 1988).

In his book on defense spending reform, Hendrickson accuses budget formulators of jealously protecting the status quo. He levels this criticism at all the participants from individual services through Congress. He reiterates several factors that Jones lists as influencing budget cutting such as political pressures, either from within the organization or from constituents, special interest groups, or the population in general. (Jones, 1984, p. 57) Hendrickson avers that those who should take responsibility for proposing reforms are instead strong advocates of the status quo. (Hendrickson, 1988, pp. 49,52)

There is another stumbling block to managing financial stress which Jones includes in his theoretical work and Hendrickson illustrates in terms of today's military. The reputation and perceived need for a program may replace objective analysis of its contribution to national defense. This masking effect may allow allocation of scarce resources to unessential missions or programs. (Jones, 1984, p. 57) There are many examples of choice of priorities, both positive and negative, based on reputation rather than analysis of effectiveness, efficiency, or mission contribution. Consider for example the V/STOL aircraft, the Army's Apache helicopter, or the NATO force structure. (Hendrickson, 1988, pp. 64-65) Each program has strong proponents and opponents, but the competition is for incremental increases in funding. The rhetoric of program justification in some instances addresses the value to various stakeholders instead of the real programmatic alternatives. Suggestions that cancelling the Apache program, or decreasing or suspending U.S. contributions to NATO might strengthen overall defense efficiency and effectiveness often are not taken seriously by DoD because of predetermination of needed programs in PPBS and are not easily changed by economic or other types of analysis. Interservice rivalry and its impact on defense policy and budget formulation is another factor that may inhibit budget reduction on the basis of efficiency criteria. (Hobkirk, 1983; Hendrickson, 1988) Further, public perception that the Department of Defense has received a disproportionate amount of the federal budget and should therefore be forced to take a larger share of the cuts is a factor mitigating for across the board reduction. In fact, the President's Blue Ribbon Commission on Defense Management found in 1986 that many Americans perceive the military budget to be nearly twice its actual size. The survey found that only seven percent of the public can accurately assess the amount of federal spending earmarked for defense. (Wildavsky, 1988, p. 366)

The popularity of the defense reform movement attests to the fact that defense spending is under close scrutiny. The need to justify every line item and to dispel the widely held notion that defense dollars are spent on unnecessary or redundant programs supports the utility of an approach to budget formulation based upon economic rationality. The Navy currently attempts to accomplish this by "scrubbing" the budget repeatedly at each level of the chain-of-command. By applying a critical mass model that links dollars to a critical mission area, the focus is shifted to: 1) what can be done with fewer dollars, and 2) the sacrifices that must occur in resources required to carry out the stated mission.

There is, in theory, a level of resources below which a command cannot continue to fulfil stated mission objectives. This level is the critical mass. A critical mass model can be constructed to delineate core resources for planning and execution within the organization and negotiation with outside agencies. Core resources are defined as those needed to fund the critical mass of mission objectives (Jones, 1985, p. 48). In theory, application of the model will increase productivity in budget formulation and negotiation because concrete resource requirements may be linked directly to mission areas. (Jones, 1985, p. 21) When the budget is presented in critical mass terms, the focus shifts to the priority of mission areas, their costs, and interrelationships. Blake notes in his master's thesis concerning funding of flight hours that, "a lack of focus creates an opportunity for miscellaneous programs to enter the responsibility network of the organization." (Blake, 1988, p. 120) Ideally, budgeting under critical mass reduces the opportunity for budget cutters to exhort a command to "bite the bullet" because core resource requirements are linked directly to mission areas. Therefore, when the budget is cut, the command or facility can state what the effect will be on specific missions, i.e., what mission activities will not be performed or will be performed less effectively. Critical mass and core modeling also provide a useful mechanism for tracking spending by mission area.

## B. THE CRITICAL MASS MODEL

At any command and mission area, funding may be challenged in budget review. Analysis of each prescribed mission area to determine critical components, or mission component inventories, and allocation of resources to support them is the key to construction of the model. This enables formulation of strategy for justifying and competing for scarce resources. Budgeting under critical mass for a state university system is the primary application to date. This method for developing the procedure is the basis for the Navy command model presented here. (Jones, 1985, pp. 44-47)

The cornerstone of the critical mass model at a Navy command is defining and agreeing upon the mission areas. At any command, there are typically multiple missions that may or may not be interrelated. For example, a typical Naval air station has as one of its missions operation of the airfield. The station also may have related or interdependent missions such as maintenance of a weapons handling capability. At a large and diverse station such as NAS Alameda, CA, there may be other missions unrelated to airfield operation, such as operation of a port with attendant responsibilities to different superiors in the chain-of-command. As the size or complexity of the command increases, the identification and prioritization of mission areas becomes more complex.

After initial documentation of the mission in mission statements, these are compiled at the responsibility center level and then forwarded through the chain-of-command. Any discrepancies or misunderstandings in mission definition are reconciled at this point. At the conclusion of this phase, each echelon agrees that all missions for which the command is responsible are included. It is important that parameters be exact and measurable. These parameters are the basis for establishing the minimum resource level required to support the mission or mission component. For example, in Navy airfield operation, fire fighting and rescue capability are required when aircraft are operating at the field. However, it is difficult to define a "sufficient" level of fire fighting ability without objective criteria. The Navy specifies the minimum number and pumping capacity of fire trucks required according to the gross weight of the aircraft normally served. If the mission statement does not specify what types of aircraft will be supported, this gross weight is unknown and it becomes more difficult to justify the number and type of fire and rescue trucks needed. Until the mission statement provides specifics, core budget resources cannot be linked directly to mission accomplishment. This example also suggests the potential snowball effect of vague or general mission statements. Without a minimum requirement for number and type of trucks, for example, other resources may become impossible to defend in negotiation. Manning, spare parts, and fuel, to name a few, may be debatable if there is no concrete requirement for the trucks they support. On the other hand, if the mission statement specifies that the airfield must accommodate P-3 aircraft, the Naval Air Training and Operating Procedures Standardization Program (NATOPS) requires at least two trucks with specified minimum water availability and trained personnel to operate and support them. (NAVAIR 00-80R-14, 1988, p. 5-2) If this requirement is not met, the facility mission cannot be accomplished in accordance with existing directives.

After mission statements are completed, each department must identify the <u>mission components</u> wholly or in part essential to accomplishment of each mission. Mission components are those functions that combine to make mission accomplishment possible. Operation of an airfield may include mission components such as operating a tower, maintaining the runway, and providing crew and equipment for contingency operations such as crashes or breakdowns. All mission components required to accomplish each mission must be included, because definition of the mission as a composite forms the basis for budget negotiation and allocation. It is equally important that every task nonessential to mission accomplishment be excluded. In application, it may be difficult for work center personnel to separate the daily workload from the concept of mission accomplishment. However, inclusion of a task in workload does not make a component essential or critical. Performance expectations are an example of this phenomenon. If the standard has been to refuel every aircraft with only twenty minutes waiting time, there may be a perception that this is a requirement for mission accomplishment. In fact, the mission may not be impaired if refueling takes longer. To identify the critical mass, the minimum acceptable performance that will permit mission accomplishment must be specified. At this stage in the process, <u>core resources</u> are defined as those resource inputs essential to operating at the critical mass or minimum level.

Up to this point the process is one of identification and iteration of missions, mission components, and core resources. After the inventory of mission components and related resources is completed, the phase of negotiation of mission priority begins. This is performed by a command-designated task force. In most cases, the department heads would form the nucleus group. They are the focal point for channeling information from the work center level to the commanding officer. Setting of mission priorities and resource allocation at this juncture incorporates externally imposed priorities as well as internally generated goals. Deciding on priorities by command personnel is an essential step in developing the critical mass model. The output of this phase of mission prioritization and core resource definition is a fully articulated plan for budgetary allocation of current assets and funding. When this allocation scheme is used in budget execution planning, it ensures that all essential mission areas are funded to permit continued operation at the critical mass or minimum level. In anticipation of budget cuts, the model becomes a bargaining tool that identifies how resources are used and exactly what will be sacrificed in terms of mission loss if funding is cut in any area.

Armed with this plan, alternative scenarios may be developed and evaluated to accommodate projected budget reductions or increases. For example, alternative plans may be prepared projecting reductions in a specific funding category. Other alternative plans may be prepared to anticipate relief from a specific mission area responsibility. The objective is to use the model's mission priorities to allocate core resources under changing conditions; i.e., the model accommodates contingency. All of this rests upon a clear definition and understanding of how resources are presently allocated by mission area and mission component.

Once the model has been applied to the command, three distinct outputs are produced. First, a comprehensive plan is in place for internal use in allocating resources to support command priorities. Second, critical mass mission areas are clearly linked to core resources so that an effective strategy for budget justification and negotiation may be developed to support and defend command priorities. For command level planners, this enables justification of their own priorities against budget cutting or redefinition from a higher echelon. Third, the opportunity cost of each activity is defined in terms of mission coverage lost if the budget is reduced.

## C. FORMAT OF THE MODEL FOR THE NAVY APPLICATION

The critical mass model is usefully displayed in matrix form. The columns (vertical) represent the assigned mission areas. The rows (horizontal) enumerate the mission components required to carry out the mission. Each cell contains the minimum resources from the mission components (row) needed to support the specified mission (column); refer to Figure 1 for an illustration of this format.

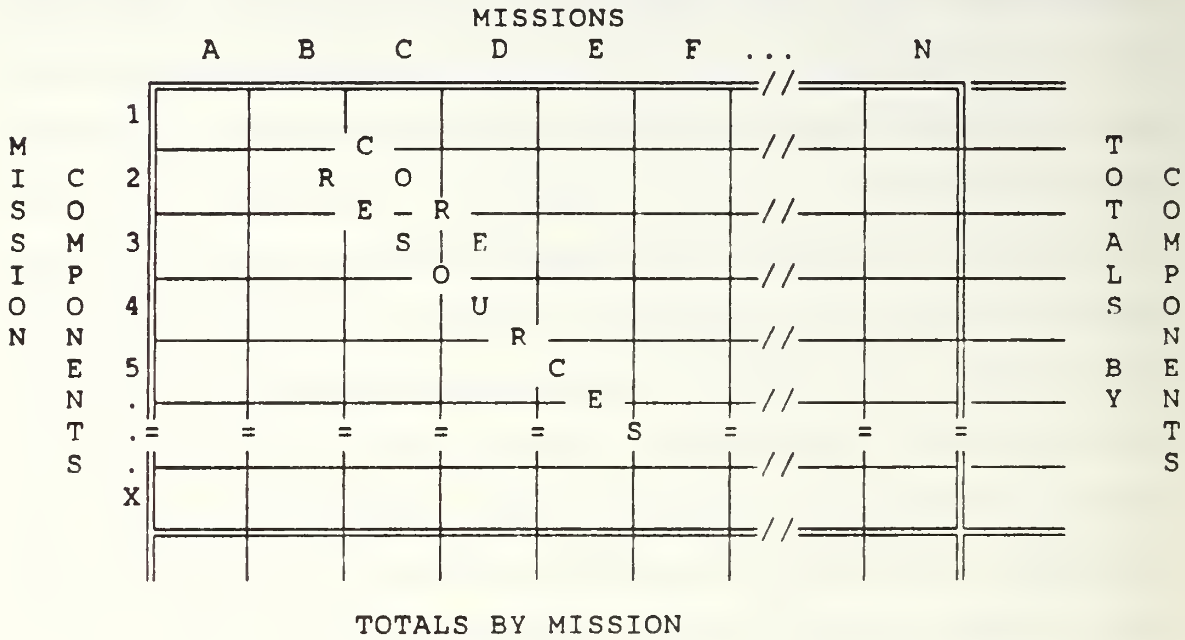


Figure 1. The Critical Mass Model Displayed in Matrix Format

The model thus developed and applied to a command illustrates mission and component interdependency by specifying minimum or core resources required for each mission with zero slack. It may be seen, for example, that if the total funds available for a particular function are below the total for that row, it would be impossible to accomplish all the missions on the chart. It also follows that if critical mass level of core resources is not available for a particular mission, the critical mass level for another mission also may be affected. This matrix representation allows decision makers, whether in the budget formulation or execution phase, to consider and make decisions on two dimensions: 1) the mission area where the cut is to be made is identified; and 2) the cutting of core resources below the level of the critical mass precludes fulfilling all of the mission requirements.

The model also allows accounting for resources in at least two ways not readily available under current budget and accounting procedures. The total of any row is the amount required (or spent) on that support function or mission component which can be directly linked to mission accomplishment. If the assigned mission responsibilities are changed, the total cost of each mission component or support function is reevaluated. In this way, the model is responsive to economies of scope because the total command cost of each mission component or support function is allocated among all the missions. The sum of any column is the total required (or spent) in accomplishing that mission.

The smaller the number of missions, the less complex the model. The reduction of the matrix to one column, or one mission area, results in a core resource distribution across a mission area. This is the case when a small command is tasked with one mission and centralized support functions are provided at no cost to the command by another echelon. Crows Landing is such an example since this command has only one primary mission and Moffett is tasked with providing support functions. Implementation analysis follows in the next chapter as the model is applied to Crows Landing.

# III. TEST APPLICATION OF THE MODEL

## A. APPLICATION

Implementation of the critical mass budgeting theory at Naval Auxiliary Landing Field Crows Landing is described and analyzed to test the applicability and utility of the theory at an operational Navy command. Two conditions of the model led to selection of Crows Landing. First, the process of budgeting under critical mass requires participation by all members of the chain-of-command and negotiation among the participants at every stage of the process. Crows Landing is a small facility with an Officer in Charge (OinC) who is personally involved in every phase of the operation. Since he is the focal point for all decisions, the negotiation process is greatly simplified and the time required to reach agreement, shortened. Second, Crows Landing has only one primary mission area. Without interdependence among missions, prioritization of mission components is reduced to identifying and clearly defining the essential support functions. The output of the critical mass budgeting process in this case is a distribution of resources or support functions over a single mission area. This distribution is a valid test of the theory with a shortened negotiation time and a simplified analysis of mission components.

Crows Landing is assigned one primary mission that is defined as follows:

> Primary mission of NALF is to support training facilities for P-3 aircraft touch-and-go operations, Fleet Carrier Landing Practice (FCLP) for fleet aircraft, and to support National Aeronautics and Space Administration (NASA) testing. (COMNAVAIRPACINST 5450.17A)

It is assumed for this application that all negotiation regarding mission assignment is completed because the originator of the instruction that assigns the mission is an echelon three commander. This implies that if Moffett, the immediate superior in the chain of command for Crows Landing, is not satisfied with the assignment, negotiation should be with seniors in the chain of command and not with Crows Landing.

The command mission statement is amplified in the instruction. Exact parameters are clearly defined and required support functions are easily identified by referring to standard Navy operating doctrine and Federal Aviation Administration (FAA) regulations. Study of the Crows Landing operation yielded five functions, or mission components, essential to performing the assigned mission. The five mission components are listed below with short titles used for ease of reference:

1. Operate an air traffic control facility in accordance with existing Navy and FAA regulations (TOWER).

2. Maintain a runway with associated taxiways and aprons including required equipment for training and support of aircraft designated in the mission statement (RUNWAY).

3. Maintain and repair navigational aids required for conduct of specified flight operations in accordance with existing Navy and FAA regulations (NAVAID).

4. Maintain continuous two-way communications capability among airfield rapid response personnel as required by current Navy directives (COMM).

5. Provide, equip, train, and support teams for fire fighting and crash/rescue operations in accordance with current Navy directives (FIRE/CRASH).

Before core resources are developed for each mission component, several additional components have to be identified because of the nature of the operation at Crows Landing. In studying the costs of a mission performed by a military organization, there are some costs which result from the unique nature of military life. These costs fall into two categories: 1) general military duties, and 2) watchstanding. General military duties are those requirements levied on military members regardless of specific job assignment. One example is physical readiness training and testing. Every member of the Navy must meet and maintain minimum physical standards. This results in additional cost for time spent by each member on actual exercise as well as time for program administration and record keeping. Certain military inspections and daily quarters are other examples of personnel costs incurred solely because the work force is military. In the application of the model to Crows Landing, personnel costs for these activities are identified as a separate component (MILITARY COST). Similarly personnel expense for the

Officer in Charge (OinC) and Assistant OinC (AOinC) is subtracted from the military wage pool before these wages are allocated because much of their time is spent in duties peculiar to the administration of a military installation. The second unique category is watchstanding. At Crows Landing, three people are on watch at all times. This means that in addition to the hours required to complete the specified mission components, Crows Landing uses 504 additional labor hours per week in watchstanding. These hours are considered direct labor since watchstanders provide fire and security watches and are qualified as a rapid response team in accordance with NATOPS airfield requirements.

As the development of the critical mass model process continues, identification of interdependence between missions becomes the focal point for negotiation. In a correctly constructed and applied critical mass model, resource allocation and the distribution of scarce resources is linked directly to mission accomplishment. Core resource requirements support budget requests. This does not imply that resources that are not a part of the critical mass cannot be requested or justified. It only demonstrates that the minimum level for mission accomplishment, the critical mass, is clearly defined; a cost-benefit analysis of resources outside the matrix would be recommended.

At Crows Landing, there is no opportunity for negotiation at this point since there is only one primary mission. Either all support functions are available at the minimum level and the mission is possible, or there is a shortfall in an area and the mission cannot be accomplished. Conversely, if the decision is made to change or cancel the mission assignment, all support functions would require reassessment. Therefore, the utility of the distribution developed for Crows Landing lies in execution vice formulation and negotiation. The distribution of core resources across the mission area is shown in matrix format in Figure 2.

| MISSION COMPONENTS | MISSION: AIRFIELD OPERATION | TOTALS BY COMPONENT |
|---|---|---|
| TOWER | $185 995 | $ 185 995 |
| NAVAID | $ 25 012 | $ 25 012 |
| COMM | $ 12 031 | $ 12 031 |
| FIRE/CRASH | $316 873 | $ 316 873 |
| RUNWAY | $ 92 972 | $ 92 972 |
| WATCHSTANDING | $445 297 | $ 445 297 |
| MILITARY COST | $268 912 | $ 268 912 |
| TOTAL FOR MISSION/ CRITICAL MASS | | $1 347 092 |

Figure 2. The Critical Mass/core Resource Model for Naval Auxiliary Landing Field Crows Landing, CA

## B. ANALYSIS

Regardless of whether the application results in a fully developed model at a multi-mission facility of the type shown in Figure 1 or a variation such as the simple, single mission Crows Landing application shown in Figure 2, the cost distribution criteria must be clearly specified. In a command involving more than one responsibility center, the cost accounting method must be uniform throughout the command in order for the results to be presented meaningfully in matrix form. Costs may be allocated to four major areas: military personnel (MILPERS), other direct costs, other indirect costs, and excluded costs. No system currently in place Navy-wide that links costs to missions as required for critical mass/core resource modelling was found during the research for this thesis. The method used for the Crows Landing critical mass/core resource model budget application is described in Chapter IV. However, it is important to acknowledge that this methodology does not represent a definitive test of the critical mass model. The model can be applied where two conditions are met: 1) all material costs essential to mission performance at the minimum level are captured; and, 2) no material costs above this critical mass level are included, i.e., there is no budgetary slack at the critical mass/core resource level.

In accounting for MILPERS, it may be useful to use an average cost for personnel qualified to do the same jobs instead of segregating costs by rating. It is common for a billet to be filled by a rating that differs from the one prescribed on the Manpower Authorization. It is also necessary for several people in a command to be qualified at each job to allow for leave, illness, etc., of the designated person. Thinking of mission accomplishment in terms of average cost per unit (i.e., man hours) from a pool of qualified labor may provide a reasonable estimate of MILPERS costs in these cases. This reasoning is illustrated in the Crows Landing example.

The defense policy of the Reagan-Weinberger-Carlucci era has promoted the concept that military costs could be reduced by contracting (OMB, 1988). For example, there are many types of installations where Marine sentries have been replaced by civilian guards. Some Navy schools are being taught by civilian teachers under contract from local colleges. For a useful cost benefit analysis of proposed contracting activity to be conducted, the actual cost of providing the mission support must be segregated from the cost of using military personnel. The Crows Landing application facilitates this type of analysis by providing a separate MILITARY COST. The direct cost of mission accomplishment may be derived because MILPERS are the labor source, and the decision making utility of the model thus presented is enhanced. The WATCHSTANDING component is segregated for a similar reason. In the case of watchstanders, however, the jobs are essential to operating the command but are often repetitive and easily reduced to standard operating procedures. In a command with multiple missions, a method for distributing this cost among the missions needs to be devised. By identifying it as a separate component, alternative ways of providing these services may be more easily evaluated.

The second category of costs allocated are those non-MILPERS costs directly related to accomplishing the mission component. In refueling aircraft, the amount (and therefore the cost) of the fuel used can be directly associated with that mission component. However, in allocating direct direct costs to mission accomplishment, the lack of an accurate measurement device is often a problem. It is obvious that if the airfield must be lighted, electricity for the lights is a direct cost. Without special metering, however, it is difficult to segregate electricity used for field lighting from electricity used to operate pinball machines at the club. A system that approximates the actual distribution must be adopted whenever the current accounting system does not identify the direct use of resources. In the Crows Landing application, a one-time sample estimate based on existing cost account categories and experience of Crows Landing personnel is used.

Similarly, indirect use of non-MILPERS resources must be distributed among functions or components. The key issues are defensibility of assumptions (reasonableness) and uniformity among responsibility centers. In the Crows Landing application, indirect costs are apportioned using a fractional rate based on the distribution of labor hours. The mechanics of this apportionment are detailed in Chapter IV.

Another cost allocation issue is determining which costs should be excluded. In order to be included as a core resource, a cost must contribute in some measurable way to mission accomplishment. Since measurement of resource use relative to mission accomplishment is difficult using the current cost accounting system, criteria for the assumptions about which costs to exclude are not clear cut. Definition of this depends, in part, on the level of aggregation of data. Payroll, for example, is a function essential to every mission since it is logical to assume that the work force must be served by a payroll system. However, since payroll is centralized Navy wide, it is unnecessary for the Crows Landing application of the model; and the indirect costs attributable, if generated, would be very small and perhaps meaningless. However, for large installations, the partial allocation of such indirect costs to critical mass may be necessary. This is a critical cost accounting choice regarding application of the model that is worthy of further research. Therefore, the payroll expenses are excluded at commands such as Crows Landing. Another question regarding indirect cost allocation is whether inclusion of such costs would benefit the decision maker. In the Crows Landing example, the cost of medical service received from Moffett by the 28 people assigned to Crows Landing is such a small percentage of the cost of operating the medical facility at Moffett that the segregation of that small cost has no effect on either command. The cost of determining or documenting the cost would exceed its usefulness in the model. If these costs were required, they would be included in a single overhead rate and applied. An important lesson to bear in mind on such issues is that information is not a free good. Highly detailed accounting data must be worth the cost to collect it in terms of utility to the decision maker. This principle must be observed in application of concepts such as critical mass and core modeling.

## IV. COST ACCOUNTING FOR CORE RESOURCES

In Chapter I, it was noted that no operational Navy cost accounting system that contains the appropriate data for critical mass budgeting was discovered during research for this thesis. This chapter explains the method used to derive the costs for the core resource application presented in Figure 2. Figure 2 is reproduced here for reference as the cost accounting methodology is explained.

| MISSION COMPONENTS | MISSION: AIRFIELD OPERATION | TOTALS BY COMPONENT |
|---|---|---|
| TOWER | $185 995 | $ 185 995 |
| NAVAID | $ 25 012 | $ 25 012 |
| COMM | $ 12 031 | $ 12 031 |
| FIRE/CRASH | $316 873 | $ 316 873 |
| RUNWAY | $ 92 972 | $ 92 972 |
| WATCHSTANDING | $445 297 | $ 445 297 |
| MILITARY COST | $268 912 | $ 268 912 |
| | | $1 347 092 |

TOTAL FOR MISSION/
CRITICAL MASS

Figure 2. The Critical Mass/core Resource Model for Naval Auxiliary Landing Field Crows Landing, CA

A one-time estimate of activity analysis data was provided by the Officer in Charge at Crows Landing (Kelley, November 1988) and was the basis for the distribution. Anthony and Herzlinger (1975) suggest using the distribution of labor hours as a convenient basis for allocating costs in non-profit organizations. This convention is adopted throughout the Crows Landing application. The Uniform Management Report (UMRC) from FAADCPAC for Moffett was the source for existing cost accounting documentation (FAADCPAC, 1988). Interviews with personnel from Moffett's Comptroller Department provided information that was not available from the UMRC (Brontsema, November 1988).

## A. MILITARY PERSONNEL (MILPERS)

The activity analysis yielded the following breakdown of military manhours on a weekly basis. The Officer in Charge (OinC) and the Assistant Officer in Charge (AOinC) were not included because their time is spent in military duties instead of airfield operation.

The total MILPERS expense from the UMRC was $1,045,575. Subtracting the cost of the OinC and the AOinC, the remaining MILPERS expense of <u>$926,991</u> was distributed among all the components except OVERHEAD (IND). OVERHEAD (DIR) includes the cost of all time spent in any capacity not specifically segregated by the analysis. Administrative time, meals and food preparation, supervision of military personnel, and inventory are a few such activities. There

MILITARY MANHOUR ALLOCATION (WEEKLY)

| | |
|---|---|
| TOWER | 31.6 |
| NAVAID | 26.6 |
| COMM | 5.3 |
| FIRE/CRASH | 330 |
| RUNWAY | 105 |
| **DIRECT LABOR/MISSION** | **498.5** |
| WATCHSTANDING | 504 |
| **TOTAL DIRECT LABOR** | **1002.5** |
| OVERHEAD | 395.5 |
| GENERAL MILITARY DUTIES | 226 |
| **TOTAL MILPERS HOURS /WEEK** (work force) | **1624** |

is no attempt to distinguish which of these functions are essential to performance of the mission because MILPERS can not be hired "part-time." Any person who spends any time in direct support of the mission must be charged to the command at the rate established by the Comptroller of the Navy. Since there is only one primary mission at Crows Landing, the entire cost must be born by that mission. This aggregation of direct and indirect overhead is a major difference between this distribution of resources over a single mission area and a core resource distribution among multiple missions.

Column (2) in Figure 3 shows the distribution of military personnel expense derived from the application of the percentage of total available hours to the $926,991, the

COST ACCOUNTING TABLE

| FUNCTION (1) | MILPERS (2) | CIVPERS (3) | MATERIAL/ UTILITIES (4) | TOTAL (5) |
|---|---|---|---|---|
| TOWER | 18 038 | 99 282 | 21 266 | 138 586 |
| NAVAID | 15 183 | | 1 511 | 16 694 |
| COMM | 2 968 | | 7 406 | 10 374 |
| FIRE/CRASH | 188 366 | 9 349 | 15 961 | 213 676 |
| RUNWAY | 59 935 | | 201 | 60 136 |
| OVERHEAD (DIR) | 225 583 | 18 386 | 28 826 | 272 795 |
| OVERHEAD (IND) | | 40 080 | 59 478 | 99 558 |
| WATCHSTANDING | 287 687 | | | 287 687 |
| MILITARY COST | 247 586 | | | 247 586 |

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| FUNCTION (1) | ALLOCATION OF OVERHEAD DIRECT (6) | INDIRECT (7) | TOTAL (8) |
|---|---|---|---|
| TOWER | 36 843 | 10 566 | 185 995 |
| NAVAID | 6 464 | 1 854 | 25 012 |
| COMM | 1 288 | 369 | 12 031 |
| FIRE/CRASH | 80 198 | 22 999 | 316 873 |
| RUNWAY | 25 518 | 7 318 | 92 972 |
| WATCHSTANDING | 22 484 | 35 126 | 445 297 |
| MILITARY COST | | 21 326 | 268 912 |
| MISSION COST | | | 1 347 092 |

Figure 3. Cost Accounting Table for Costs Essential to the Performance of the Mission of Naval Auxiliary Landing Field Crows Landing, CA

cost of MILPERS adjusted to exclude OinC and AOinC. The cost of the OinC and the AOinC was added to MILITARY COST as a cost of using military personnel after the General Military Duties percentage was calculated. Except for those two specific jobs, average hourly wage was used since many of the essential jobs may be performed by any qualified person regardless of pay grade.

## B. CIVILIAN PERSONNEL (CIVPERS)

The air traffic controllers were considered 100% essential to tower operation. Their combined salaries of $84,929 were accelerated 16.9% for fringes to yield CIVPERS cost for TOWER. 16.9% is used throughout this example as the rate to calculate CIVPERS fringes (Brontsema, 1988). FIRE/CRASH was allotted the civilian personnel cost for fire truck maintenance plus the 16.9% for fringes. This maintenance cost was considered direct labor since the mission component specifies "equip...and support" firefighters.

The estimated activity analysis for CIVPERS showed that the transportation mechanic spent 20% of his time in maintenance/repair of airfield equipment and support vehicles (Kelley, November 1988). This percentage was applied to Moffett's total CIVPERS expense for vehicle maintenance and then 16.9% applied to the result. This total is included in OVERHEAD (DIR).

The remaining two CIVPERS are maintenance mechanics who perform myriad public works functions. The estimated activity analysis showed 20% of their time spent on airfield maintenance essential to mission accomplishment (Kelley, November 1988). Therefore, the cost of this support was computed by multiplying their wages and fringes by 20%.

Since this figure included maintenance and repairs to runways, lighting, drainage, navigation aids, and other associated airfield property, the cost was treated as direct overhead and included in OVERHEAD (DIR).

Total budget authority for CIVPERS was $141,610 (Base Operating Support) plus $53,339 (Maintenance of Real Property). CIVPERS expenses directly related to mission accomplishment, as calculated above, totaled $127,017. The remainder, $67,932, is indirect overhead. For example, maintenance and repair of general base vehicles is not directly required to support the mission. In the case of these vehicles, however, it may be that they are used for activities such as picking up spare parts for repair of tower equipment or driving to get operational message traffic from the communications center that serves Crows Landing. Maintenance of real property, for example, maintenance and repair of base roads, may also be indirectly related to mission accomplishment since personnel and equipment must be able to reach the runway area to perform duties such as fire and rescue operations. To capture the portion of these indirect costs essential to continued mission accomplishment, 59% of the CIVPERS indirect overhead expense was included in the distribution as OVERHEAD (IND). This percentage is based on the ratio of total DIRECT LABOR hours (1002.5) plus CIVPERS hours deemed essential to mission accomplishment (144 hours) to total labor hours.

Total labor hours include TOTAL MILPERS, OinC and AOinC, and six civilians.

CIVPERS expense allocation is shown in column (3) of Figure 3.

## C. MATERIAL

Material includes all expenses except personnel and travel. For example, the cost of garbage pick-up, pest control, contracted office machine repair, and utilities are among those included in this category.

Material expense for airfield operations was divided between TOWER and NAVAID by applying a ratio derived as follows:

$$\frac{\text{CIVPERS wage for air traffic controllers}}{\text{CIVPERS wage for 'Operations Aux F'}} = \frac{\$84\ 929}{\$96\ 434} = 88\%$$

Total of material expense for 'Operation Aux F' and 'Misc Services' from Moffett cost accounting data was divided using this percentage between TOWER (88%) and NAVAID (12%).

The COMM and FIRE/CRASH figures were taken directly from the Moffett Uniform Management Report (UMRC).

Runway maintenance was assumed to be 20% of the 'Grounds Maint' expense based on Public Works labor estimates and is included as a part of the RUNWAY account.

OVERHEAD (DIR) includes both materials and utility costs. Twenty percent of any maintenance material not attributed to a specific support function is included because the activity analysis estimates that 20% of Public

Works labor hours were spent in direct support of the mission. Utility costs (including materials for potable water) directly linked to mission accomplishment were estimated at 59% of the total utility expense. Fifty-nine percent is the ratio of TOTAL DIRECT LABOR hours plus CIVPERS hours deemed essential to mission accomplishment to total labor hours. Total labor hours for this calculation include TOTAL MILPERS, the OinC and AOinC, and six civilians.

OVERHEAD (IND) was calculated using the same rationale and method applied to CIVPERS expense. Total indirect materials was calculated by subtracting the direct material costs already identified as core resources ($75,171) from the total material expense ($175,981). 59% of indirect materials was included as mission essential.

## D. ALLOCATION OF OVERHEAD

Allocation of overhead is shown in columns (6) and (7) of Figure 3. Direct overhead is allocated among six accounts: the five mission components and WATCHSTANDING. Direct labor hours estimated in the activity analysis as a percentage of total direct labor hours is the distribution criterion. One hundred and twenty hours are added to TOWER for the civilian air traffic controllers. This represents the total time per week worked by three controllers since the activity analysis estimated 100% of their time spent in direct support of TOWER. Indirect overhead is allocated among all seven remaining accounts using labor hours as estimated in the activity analysis with the two additions explained below as a proxy distribution. Labor hours for GENERAL MILITARY DUTIES is increased 80 hours to include OinC and AOinC functions as the basis for MILITARY COST. TOWER is again increased 120 hours for direct labor attributed to air traffic controllers. The total in column (8) is the final distribution of costs which appears in Figure 2.

## E. CRITICALITY OF ASSUMPTIONS

The cost accounting methodology and assumptions in this chapter are not critical to the application of the model. Other assumptions would change the dollar values in the body of the distribution of support functions across the mission area but would not lessen the applicability or utility of the model. The cost application here shows by example how core resources are defined within the critical mass model methodology.

# IV. CONCLUSIONS AND RECOMMENDATIONS

## A. CONCLUSIONS

Application of the model to Crows Landing suggests that the critical mass concept can be applied to an operational command if suitable staff commitment and expertise are available to support it. The model may be more useful than the current incremental approaches because of its utility in the formulation, negotiation, and execution phases of budgeting. It is designed primarily to improve budget justification under fiscal stress. Direct linkage of resources to mission accomplishment provides the framework necessary to strengthen the command's negotiating strategy at any juncture of the budgetary process. This format may strengthen and protect the command from priorities imposed by outside forces, or more likely will permit commands to identify mission opportunity costs or losses resulting from budget cuts. The critical mass model may be superior to current budget formats in the execution phase because resources are formally allocated based on mission priority vice criteria such as fairness or equity, politics, or existing pro-rata share of the budget base.

## B. DATA AVAILABILITY

In the test case, some historical cost accounting data needed to apply the model were not readily available in existing accounting or manpower records. Each phase of the model requires specific information regarding resource utilization. The current systems for accounting for resources are not designed to support this type of application. Data are originally collected in sufficient detail; however, the management reporting structure, the UMRC, does not reproduce that level of detail in its output format. Current archiving and reporting systems need to be reworked to enable ready access to needed data to adapt the model to Navy-wide use.

## C. LIMITATIONS

The major problem in applying the model to a command is lack of availability of needed data. The command does not have the data readily available in existing reporting systems. Reluctance to generate and furnish the data for this type of research may be attributed to two causes. First, it is difficult and time consuming to develop systems to document the needed information in sufficient detail. Therefore, budget planners and executors who believe that existing systems adequately support the budget process do not have incentive to volunteer the resources needed for this task. Second, the current budgeting climate is characterized by a fear of budget cuts. A command that has not felt the impact of reductions may be uncooperative in providing data perceived to be threatening because it might justify a shift in funding priorities so that the command would lose budget share.

## D. ORGANIZATIONAL IMPLEMENTATION FEASIBILITY

It is unlikely that a radical change in the budget process such as that implied by the critical mass concept will be accepted in defense applications without significant additional testing. Until steady state or decreased funding has significant negative impact on command programs, it will be difficult to convince potential users of the utility of a different system, especially one that ignores the premise of incrementalism. However, budgeting for critical mass is not offered as an alternative to PPBS. Rather, it is intended as a command-level approach that would be implemented at the discretion of a comptroller, e.g., in an installation or a command. As such, the command may strengthen its budgetary program by developing an internal data base to support critical mass/core resource identification.

Implementation of budgeting for critical mass at the installation, type command, or fleet level would require modification of existing cost accounting systems. It would also require a comprehensive review of the current mission assignment policies and practices. Since information is not a free good, an analysis of the utility of the critical mass/core resource model for decision making should precede any change.

## E. RECOMMENDATIONS FOR FURTHER RESEARCH

The application of the critical mass model to a single-mission command generated a distribution of support functions over a mission area. The next step in the process of validating the model is application to a more complex command with significant interdependencies among missions and mission components.

The model, thus applied, may be superior to current methods of budget formulation and execution. A comparison between budget execution under the critical mass methodology and current practices should be undertaken to test this hypothesis.

To evaluate critical mass application, accounting systems need to be designed to support the distribution of resources among mission components or support functions. The need for such systems is recognized in some communities, and the issue is the topic of current research in limited applications such as the P-3 flight hour program [Blake, 1988]. Attempts to design such systems require expertise in the various mission fields as well as cost accounting to create a new system or modify the reporting in current systems to provide the detail necessary to allocate costs accurately to mission components. The level of aggregation of costs for centrally provided functions, such as payroll and other support activities, plays an important role in this determination; i.e., application of the model requires that a number of choices be made on indirect cost allocation. In addition, a separate system may be needed to link core resources to classified missions.

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